


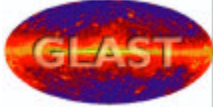
Document Projet / Project Document		
	GLAST LAT CAL <i>Mechanical Structure</i>	Ref : GLAST-LLR-PR-072
		Issue : A
		Date : September 26, 2003
		Page : i
Procedure of metrology composite structure Models FM		

"As Run" Procédure	
Date Démarrage:	Date Fin :

SLAC reference :


Change History log

A	26 septembre 2003		P.Prat		S. Le Quellec	O. Ferreira
Ind.	Date	Modifications	Prepared	Checked	PA Approval	Project Approval

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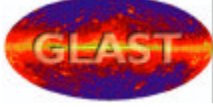
AS-RUN SUMMARY

IDENTIFICATION						
Equipement:			Modèle:		Numéro de Série :	
OPERATEURS						
The operators mentioned below certify the correct execution of this Procedure Have-Run in agreement with its contents						
Nom		Fonction		Date		Signature
OPEN TASKS						
Test	Phase	Etape	Commentaires		Clôture	Date
NON CONFORMITES						
Test	Phase	Etape	Spécification	Résultat	FA n°	FA Titre

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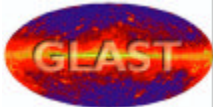
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List Acronyms

AIT	Assemblage, Integration et Test
AFEE	Analog Front-End Electronic
CAL	sous-système calorimètre du LAT
CDE	Crystal-Diode Element
CEA	Commissariat à l'Energie Atomique
CNES	Centre National d'Etudes Spatiales
DCI	Dossier de Contrôle des Interfaces
DCF	Dossier de Fabrication et de Contrôle
DD	Dossier de Définition
DJD	Dossier Justificatif de la Définition
EM	Engineering Model
EMC	Electromagnetic Compatibility
EGSE	Electric Ground Support Equipment
GLAST	Gamma-Ray Large Area Space Telescope
LAT	Large Area Telescope
LLR	Laboratoire Leprince-Ringuet
N/A	Not Applicable
NRL	Naval Research Laboratory
PCB	Printed Circuit Board
SLAC	Stanford Linear Accelerator Center
STB	Spécification Technique de Besoin
TBR	To Be Resolved
TBD	To Be Defined
TBC	To Be Confirmed


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1 OBJECT

This procedure describes the process of checking metrological of the composite part of the mechanical structure of calorimeter GLAST.

This unit is made up:

- of a composite carbon structure intended for housing of 96 crystals of CsI
- titanium inserts planned for the fixing of the reinforcement.

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2 DOCUMENTS


2.1 APPLICABLE DOCUMENTS

All the documents are listed in chapter 3 of the CIDL (GLAST-LLR-Li-029).

2.2 REFERENCE DOCUMENTS

The last version of the following reference documents is indicated in chapters 4 (documents project) and 5 (plans) of the CIDL (GLAST-LLR-Li-029).

	<i>Title</i>	<i>Reference</i>	<i>Type</i>
RD01	Plan structure composite	GLT-LLR-00-02	Plan
RD02	Flight structure verification plan	GLAST-LLR-SP-078	Document projet
RD03			
RD04			

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3 ENVIRONMENT

3.1 PERSONNEL

The whole of the tasks will be carried out by qualified personnel.

The team will be at least made up of:

- 1 person in charge for the activity,
- 1 qualified technician,
- 1 representative Quality.

3.2 PARTICULAR PRECAUTIONS

The whole of the stages must be carried out in gray room of metrology.

Handling will be done using gloves.

Any variation compared to this procedure will be subjected to the agreement of the Qualité person in charge.

3.3 CONSUMABLE MATERIEL

The consumable material hereafter is necessary to carry out the activities.

Protective gloves out of latex not powdered

3.4 FACILITIES

- The checking of the equipment will be carried out in room of metrology in the buildings of the Laboratory Leprince Ringuet of the Polytechnique school.

3.5 CLIMATIC ENVIRONMENT AND CLEANLINESS

The control field will be maintained under the following conditions:

- Temperature: $21^{\circ}\text{C} \pm 2^{\circ}\text{C}$
- Relative humidity: $< 60\%$
- Cleanliness: Gray Room

These conditions will be controlled by the Qualité person in charge during metrological control.


The room of metrology of the machine shop of the LLR is controlled in temperature but not in moisture.

If moisture is higher than the required rate, the checking must be deferred until obtaining the conditions required.

3.6 TOOLS

The tools following are necessary to carry out the activities:

- Three-dimensional controller: Coordinate Measuring Machine Mitutoyo Euro-m574 and software COSMOS,
- 2 holds to position the composite structure on the marble of the machine of three-dimensional measurement,
- 40 spacers allowing to refer the points of measurement on the shoulders of the inserts (spacers calibrated fascinating support on the shoulders of the inserts).

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4 DATA PROCESSING

4.1 ANOMALIES

Any anomaly detected by the team will be the subject of a card of anomaly.

4.2 RECORDING OF THE FOLLOW-UP OF THE CHECKING

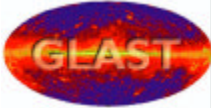
- All the data collected during the activities of checking will have to be recorded on this document as "an Ace run".

They will include moreover:

- the update of **the Following Booklet (LogBook)**,
- cards of anomalies (supplemented photographs and statements of measurement)

4.3 REPORT/RATIO OF CHECKING

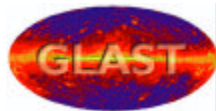
- A Report/ratio of Checking will be written at the end of the checking.

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5 PROCEDURE

The various phases of the checking are detailed in the following pages.

Description de l'activité :			
Num. Oper.	Description de l'opération	Procédure / Réf. feuille résult. ou commentaires	Sign. & Date
0	PREPARATION <ul style="list-style-type: none"> To check the presence of the documents mentioned with the § 2.2. To check the presence of the means mentioned in the paragraph 3. To check that the spacers of reference are fixed on the side inserts 		
1	CHECKING OF THE CLIMATIC CONDITIONS <ul style="list-style-type: none"> To check that the necessary climatic conditions with the § 3.5. are acceptable. To record the temperature and the relative humidity. 		



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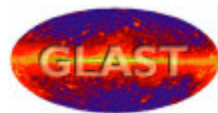
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Description de l'activité :

Num. Oper.	Description de l'opération	Procédure / Réf. feuille résult. ou commentaires	Sign. & Date
2	<p>CHECKING OF THE POSITIONING OF THE INSERTS One will use gauges to check the positioning of the higher, lower and side inserts:</p> <ul style="list-style-type: none"> • Checking of the positioning of the 16 inserts of the higher face (Z^+) • Checking of the positioning of the 25 inserts of the higher face (Z^-) • Checking of the positioning of the 10 inserts of the side face (X^+) • Checking of the positioning of the 10 inserts of the side face (X^-) • Checking of the positioning of the 10 inserts of the side face (Y^+) • Checking of the positioning of the 10 inserts of the side face (Y^-) <p>The gauges include/understand holes circulaires whose diameters correspond to the ray of the inserts plus the tolerance of positioning of the inserts. The inserts must be able to be placed in these holes.</p>	To supplement by the photographs of the gauges	
3	<p>CHECKING OF THE CELLS One will use a gauge to check dimensions min of the 96 cells. The bar gauge of dimension max must be able to fit in each cell without exerting of push.</p>	To supplement by the photograph of the gauge	



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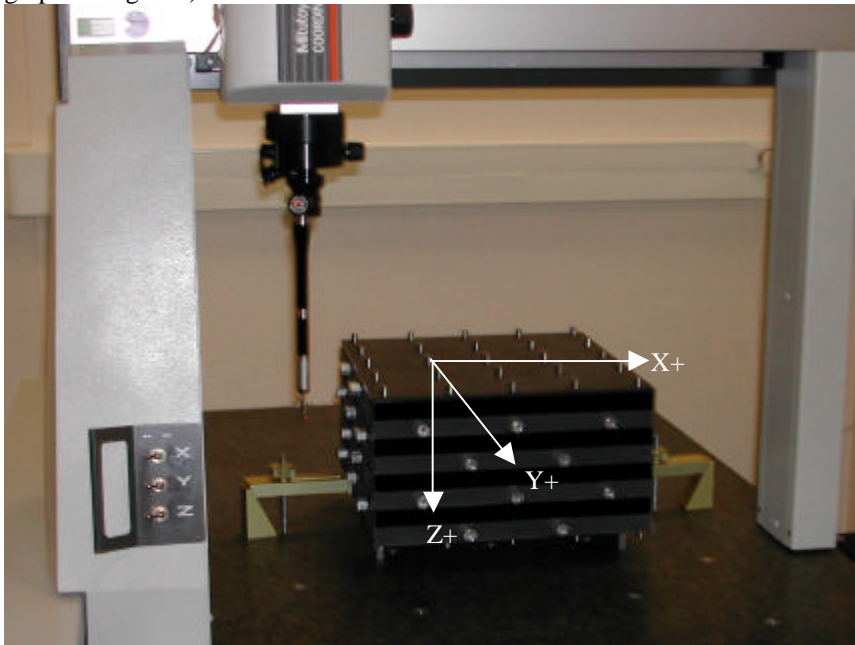
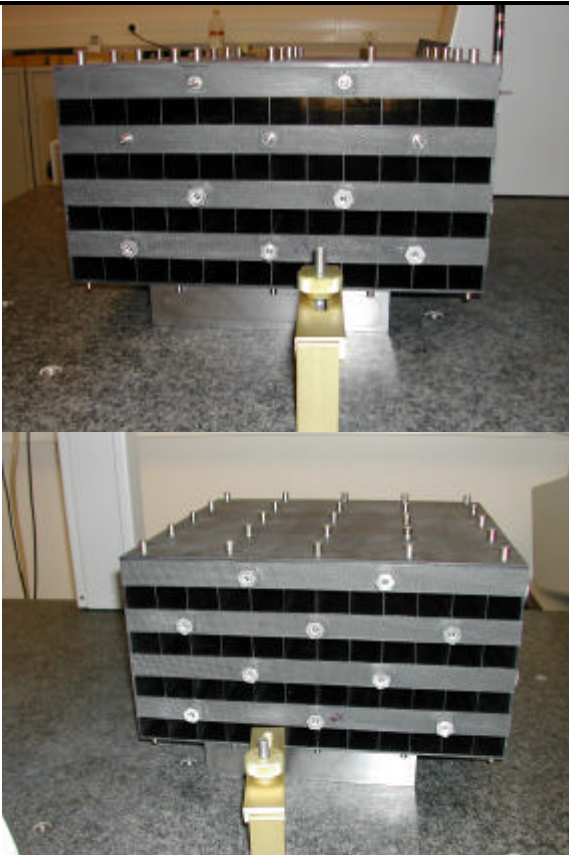
Ref GLAST-LLR-PR-072

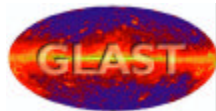
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Description de l'activité :

Num. Oper.	Description de l'opération	Procédure / Réf. feuille résult. ou commentaires	Sign. & Date
4	<p>POSITIONING OF THE PIECE ON THE BENCH OF METROLOGY</p> <ul style="list-style-type: none"> To position the composite structure on the face higher face Z^+ on the feeler gages height 43 mm on with dimensions X and X+. The holds must be into obstinate on the inserts, with dimensions intern (see photographs Ci against). To align the axis X^+ structure with the axis Y^+ of the machine 3d To put the higher face of the structure (face Z^+) to the bottom (see photo below). To immobilize the part with 2 supports with dimensions X+ and X on the cells n°5 (see photographs Ci against) 		



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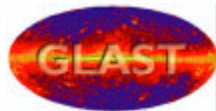
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Description de l'activité :

Num. Oper.	Description de l'opération	Procédure / Réf. feuille résult. ou commentaires	Sign. & Date
5	<p>CALIBRATION OF THE FEELER IN CROSS</p> <ul style="list-style-type: none"> • To mount the feeler in cross with the average extension and the short extension as shown on the photograph opposite. • To launch the software `COSMOS' • To carry out the calibration of the feeler in cross by using the sphere of calibration • The feelers definite such as are represented below: <div data-bbox="490 754 1120 1500"> </div>		



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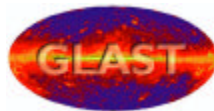
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Description de l'activité :

Num. Oper.	Description de l'opération	Procédure / Réf. feuille résult. ou commentaires	Sign. & Date
6	<p>CHECKING OF TOTAL DIMENSIONS</p> <p>Total dimensions are:</p> <ul style="list-style-type: none"> - Width of the structure between shoulder of the opposite inserts of faces: C1 - Height of the structure: C2 - Flatness of the 6 faces, parallelism of the faces Z^+ and Z^-, and perpendicularity of the faces X^+, Y^+, X^- and Y^- compared to face Z^- <p>The tables of measurements with the limits of acceptance are exposed following pages.</p> <p>Necessary precision: $\pm 20 \mu\text{m}$ – Afficher the μm for the statement of dimensions.</p> <p>The coasts are located on plan RD01</p> <p>OPERATIONS:</p> <p>Definition of the reference frame part</p> <ul style="list-style-type: none"> • To launch the program `Structure EM' on the software COSMOS • To take 13 points of measurement with feeler 5 on face Z^- composite structure such as defined in appendix figure 7-2 La machine of three-dimensional measurement must define a datum-line part starting from these 13 points. • To take 4 points of measurement on the circumference of the central insert (marked Origin in appendix figure 7-1) with feeler 5 • To take 4 points of measurement on the circumference of the insert centers right (marked X1 in appendix figure 7-1) with feeler 5 <p>Note:</p> <p>The reference frame part is defined by the program starting from these measurements as described in appendix figure 7-1</p>		



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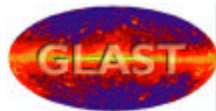
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Description de l'activité :

Num. Oper.	Description de l'opération	Procédure / Réf. feuille résult. ou commentaires	Sign. & Date
6 (suite)	<p>CHECKING OF TOTAL DIMENSIONS (CONTINUATION)</p> <p>OPERATIONS:</p> <p>Measurements of flatnesses, parallelisms and perpendicularities and width</p> <ul style="list-style-type: none"> To take 8 points of measurement with the feelers on the face Z^+ (laid out below) according to the appendix figure 7-3: <ul style="list-style-type: none"> 3 points with dimensions face Y^+ with feeler 2 3 points with dimensions face Y^- with feeler 4 1 point with dimensions face X^+ with feeler 3 1 point with dimensions face Y^- with feeler 1 To take 1 point of measurement with feeler 3 on each of the 10 inserts of the face X^+ (to take the inserts of left on the right, and upwards) To take 1 point of measurement with feeler 1 on each of the 10 inserts of face X^- (to take the inserts of left on the right, and upwards) To take 1 point of measurement with feeler 2 on each of the 10 inserts of the face Y^+ (to take the inserts of left on the right, and upwards) To take 1 point of measurement with feeler 4 on each of the 10 inserts of the face Y^- (to take the inserts of left on the right, and upwards) <p>Levellings</p> <ul style="list-style-type: none"> To take 8 points of measurements with the feelers on faces Z^- and Z^+ such as defines in appendix figure 7-6: <ul style="list-style-type: none"> 1 point on face Z^- and 1 point face Z^+ with dimensions $X^- Y^+$ with feeler 2 1 point on face Z^- and 1 point face Z^+ with dimensions $X^+ Y^+$ with feeler 2 1 point on face Z^- and 1 point face Z^+ with dimensions $X^+ Y^-$ with feeler 4 1 point on face Z^- and 1 point face Z^+ with dimensions $X^- Y^-$ with feeler 4 		



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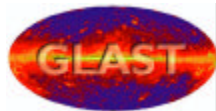
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Description de l'activité :

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7	<p>CHECKING OF DIMENSIONS OF THE CELLS Dimensions of the cells are:</p> <ul style="list-style-type: none"> - height: C3 - width: C4 <p>The tables of measurements with the limits of acceptance are exposed paragraph 6.4. Necessary precision: $\pm 20 \mu\text{m}$ – Afficher the μm for the statement of dimensions. The coasts are located on plan RD01.</p>		
7 (suite)	<p>CHECKING OF DIMENSIONS OF THE CELLS (CONTINUATION)</p> <ul style="list-style-type: none"> • Face X⁺: <p>OPERATIONS:</p> <ul style="list-style-type: none"> ▪ to launch the program `Cell EM' ▪ to reiterate on the 3 cells located in appendix figure 7-8 (grayed cells of the figure) the following operations (to measure the cells in the order: cell 1-1, cell 3-6 and cell 7-12) <ul style="list-style-type: none"> – to position feeler 3 in the cell – to block the feeler along axis X of the three-dimensional controller – to take 2 points of measurements on each face of the cell according to the order given in appendix figure 7-7: With, B, C, D, E, F, G, and H 		



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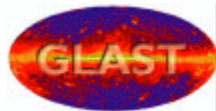
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Description de l'activité :

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4 (suite)	<p>CHECKING OF DIMENSIONS OF THE CELLS (CONTINUATION)</p> <ul style="list-style-type: none"> • Face Y⁺: <p>OPERATIONS:</p> <ul style="list-style-type: none"> ▪ to launch the program `Cell EM' ▪ to reiterate on the 3 cells located in appendix figure 7-9 (grayed cells of the figure) the following operations (to measure the cells in the order: cell 2-1, cell 4-6 and cell 8-12): <ul style="list-style-type: none"> - to position feeler 2 in the cell - to block the feeler along the axis Y of the three-dimensional controller - to take 2 points of measurements on each face of the cell according to the order given in appendix figure 7-7: With, B, C, D, E, F, G, and H 		



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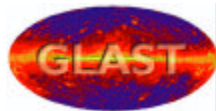
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4 (suite)	<p>VERIFICATION DES DIMENSIONS DES CELLULES (SUITE)</p> <ul style="list-style-type: none"> • Face X :- <p>OPERATIONS :</p> <ul style="list-style-type: none"> ▪ to launch the program ` Cell EM' ▪ to reiterate on the 3 cells located in appendix figure 7-10 (grayed cells of the figure) the following operations (to measure the cells in the order: cell 1-1, cell 3-6 and cell 7-12): <ul style="list-style-type: none"> - to position feeler 1 in the cell - to block the feeler along axis X of the three-dimensional controller - to take 2 points of measurements on each face of the cell according to the order given in appendix figure 7-7: With, B, C, D, E, F, G, and H 		



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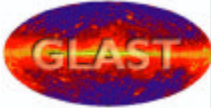
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Description de l'activité :

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<p>4 (suite)</p>	<p>CHECKING OF DIMENSIONS OF THE CELLS (CONTINUATION)</p> <ul style="list-style-type: none"> • Face Y⁻ : <p>OPERATIONS :</p> <ul style="list-style-type: none"> ▪ to launch the program `Cell EM' ▪ to reiterate on the 10 cells located in appendix figure 7-11 (grayed cells of the figure) the following operations (to measure the cells in the order: cell 2-1, cell 4-6 and cell 8-12): <ul style="list-style-type: none"> - to position feeler 4 in the cell - to block the feeler along the axis Y of the three-dimensional controller - to take 2 points of measurements on each face of the cell according to the order given in appendix figure 7-7: With, B, C, D, E, F, G, and H 		
<p>5</p>	<p>FIN</p>		

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6 TABLE OF STANDARD MEASUREMENTS

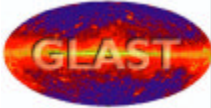
6.1 WIDTH OF THE STRUCTURE ENTERS THE SHOULDERS OF THE OPPOSITE INSERTS OF FACES

Côtes		Spécification		Mesures									
		Min	Max	A	B	C	D	E	F	G	H	I	J
C1	Face X^+ / X^-	340.6	341										
C1	Face Y^+ / Y^-	340.6	341										

Table 6-1 : Standard table of measurement of dimensions of the composite structure: widths between shoulders of the inserts

The location of the inserts is clarified in appendix figure 7-4 and figure 7-5.

The catch of the points of measurement on the shoulders of the inserts is carried out by using calibrated spacers fascinating support on the shoulders of the inserts.

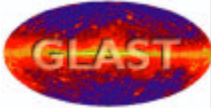
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6.2 HEIGHT OF THE STRUCTURE

Côte	Specification min	Specification max	Mesures			
			A	B	C	D
C2	176.8	177.2				

Table 6-2 : Tableau de mesure type des dimensions de la structure composite: hauteur

Locations of the 8 points of measurement height, taken on the faces Z^+ and Z^- , are defined in appendix figure 7-6.

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6.3 PLANEITY, PARALLELISM AND PERPENDICULARITY

Measurements are taken from:

- points on the 10 inserts for the faces X^+ , X^- , Y^+ and Y^- (3 measurements by points)
- 12 points for the face Z^+
- 13 points for face Z^-

The location of the 10 points of the faces X^+ and X^- is defined in appendix figure 7-4.

The location of the 10 points of the faces Y^+ and Y^- is defined in appendix figure 7-5.

The location of the 8 points of the face Z^+ is defined in appendix figure 7-3.

The location of the 13 points of faces Z^- is defined in appendix figure 7-2.


Specification of flatness: $\leq 0,40$ mm

Specification of parallelism $\leq 0,40$ mm (TBC)

Specification of perpendicularity $\leq 0,40$ mm (TBC)

Flatness in mm						Parallelism in mm			Perpendicularity in mm			
X^+	X^-	Y^+	Y^-	Z^+	Z^-	$X^+//X^-$	$Y^+//Y^-$	$Z^+//Z^-$	$X^+ \perp Z^-$	$Y^+ \perp Z^-$	$X^- \perp Z^-$	$Y^- \perp Z^-$

Table 6-3 : Standard table of measurement of flatnesses, parallelisms and perpendicularities

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6.4 DIMENSIONS OF THE CELLS

Dimensions of the following cells, width and height, must be measured by taking 8 points (cf annexes figure 7-7) on the faces X^+ and X^- :

cell 1-1, cell 3-6 and cell 7-12.


Locations of the cells X^+ and X^- are defined in appendix figure 7-8 and figure 7-10

Couche 1 Cell 1-1				
Dim	Min	Max	Face	1
C3= H	20.45	20.55	X^+	
C3= H	20.45	20.55	X^-	
C4 = L	27.30	27.40	X^+	
C4= L	27.30	27.40	X^-	

Couche 3 Cell 3-6				
Dim	Min	Max	Face	1
C3= H	20.45	20.55	X^+	
C3= H	20.45	20.55	X^-	
C4 = L	27.30	27.40	X^+	
C4= L	27.30	27.40	X^-	

Couche 7 Cell 7-12				
Dim	Min	Max	Face	1
C3= H	20.45	20.55	X^+	
C3= H	20.45	20.55	X^-	
C4 = L	27.30	27.40	X^+	
C4= L	27.30	27.40	X^-	

Table 6-4 : Tables of standard measurement of dimensions of the cells of the composite structure faces X^+ and X^-

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Dimensions of the following cells, width and height, must be measured by taking 8 points (cf annexes figure 7-7) on the faces Y^+ and Y^- :

cell 2-1, cell 4-6 and cell 8-12.


The locations of the cells of the faces Y^+ and Y^- are defined in appendix figure 7-9 and figure 7-11.

Couche 2 Cell 2-1				
Dim	Min	Max	Face	1
C3= H	20.45	20.55	X^+	
C3= H	20.45	20.55	X^-	
C4 = L	27.30	27.40	X^+	
C4= L	27.30	27.40	X^-	

Couche 4 Cell 4-6				
Dim	Min	Max	Face	1
C3= H	20.45	20.55	X^+	
C3= H	20.45	20.55	X^-	
C4 = L	27.30	27.40	X^+	
C4= L	27.30	27.40	X^-	

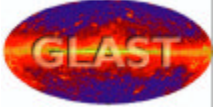
Couche 8 Cell 8-12				
Dim	Min	Max	Face	1
C3= H	20.45	20.55	X^+	
C3= H	20.45	20.55	X^-	
C4 = L	27.30	27.40	X^+	
C4= L	27.30	27.40	X^-	

Table 6-5 : Tables of standard measurement of dimensions of the cells of the composite structure faces Y^+ and Y^-

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7 ANNEXES

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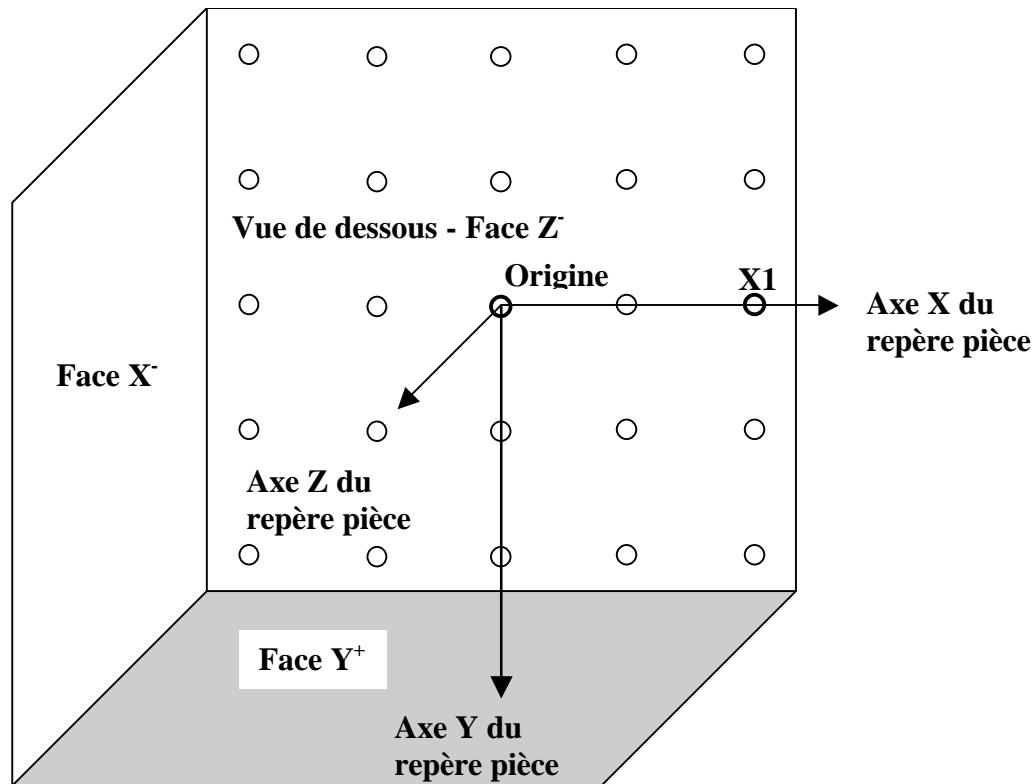
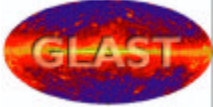


Figure 7-1 : Repère pièce

The X-Y.est plan defined by the 13 points of reference (represented by the 13 cross) taken on lower face Z (see figure 7-3).

Axis X is defined by the 2 points of intersection of the central axes of the located inserts Origine and X1 with plan X there.

The axis Y is defined by the line of plan X there perpendicular to axis X and passing by the Origine point defined to the central insert.

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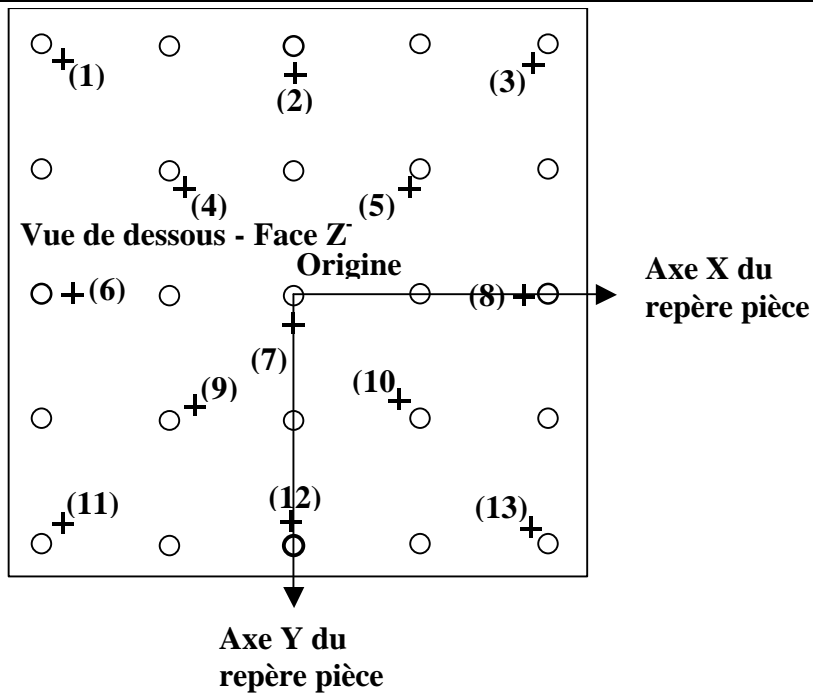


Figure 7-2 : Points of measurement on face Z⁻

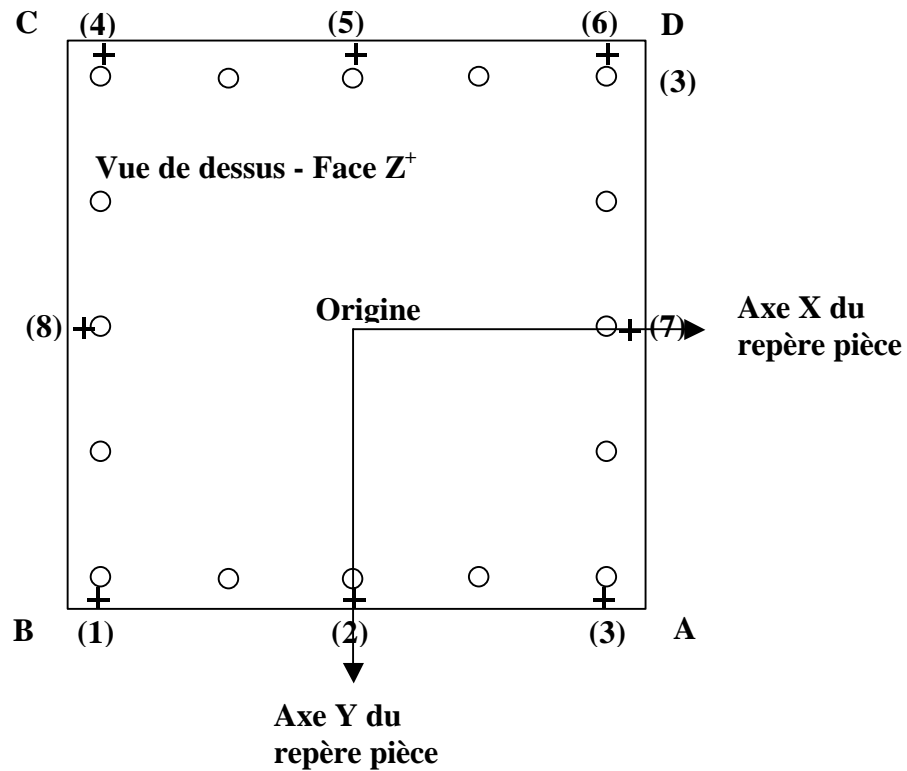


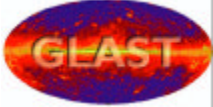
Figure 7-3 : Points of measurement on the face Z⁺

Couches	Inserts											
8	(J)						(I)					
7	Cell 7-12											
6	(H)				(G)				(F)			
5												
4	(E)						(D)					
3												
2	(C)				(B)				(A)			
1												Cell 1-1

Figure 7-4 : Repérage des inserts du plan X⁺ de la structure composite

Couches	Inserts											
8	Cell 8-12											
7	(J)				(I)				(H)			
6												
5	(G)						(F)					
4												
3	(E)				(D)				(C)			
2												Cell 2-1
1	(B)						(A)					

Figure 7-5 : Location of the inserts of the plan Y⁺ of the composite structure

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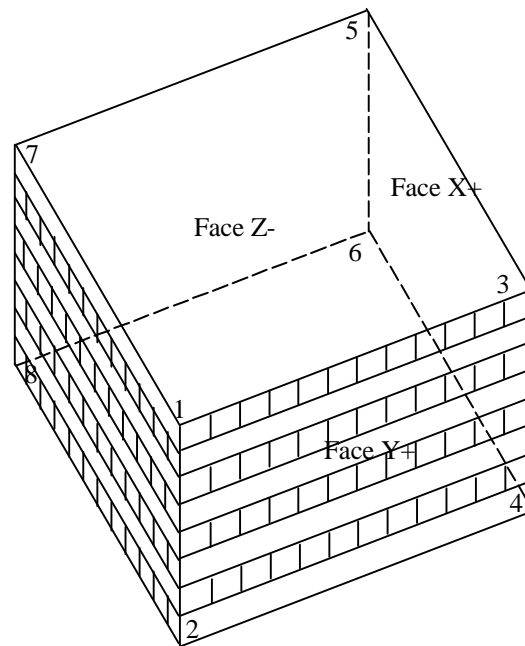
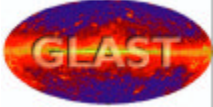


Figure 7-6 : Location of the points of measurement height of the plans Z^+ and Z^- composite structure

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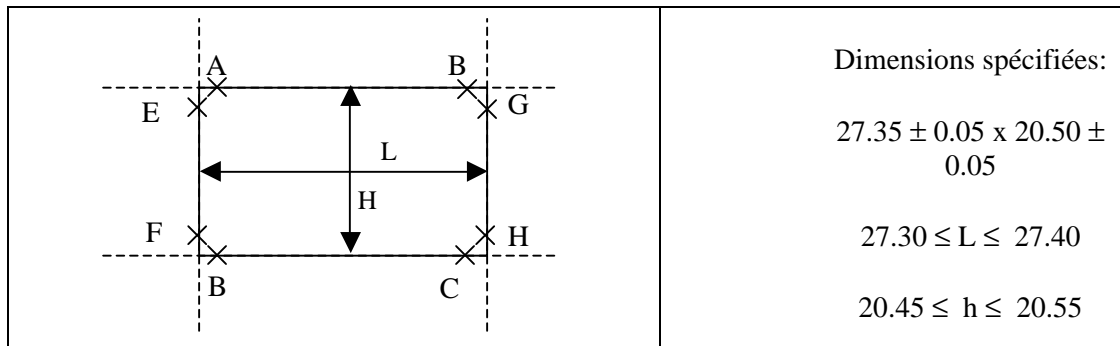
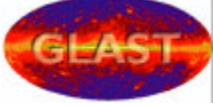


Figure 7-7 : Dimensions of the cells seen of the plans X^+ , Y^+ , X^- and Y^- .

H is defined by the points A, B, C and D

L is defined by the points E, F, G and H


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Couches	12	11	10	9	8	7	6	5	4	3	2	1
7	o						o					
	Cell 7-12	Cell 7-11	Cell 7-10	Cell 7-9	Cell 7-8	Cell 7-7	Cell 7-6	Cell 7-5	Cell 7-4	Cell 7-3	Cell 7-2	Cell 7-1
	o						o					
5	Cell 5-12	Cell 5-11	Cell 5-10	Cell 5-9	Cell 5-8	Cell 5-7	Cell 5-6	Cell 5-5	Cell 5-4	Cell 5-3	Cell 5-2	Cell 5-1
	o						o					
	Cell 3-12	Cell 3-11	Cell 3-10	Cell 3-9	Cell 3-8	Cell 3-7	Cell 3-6	Cell 3-5	Cell 3-4	Cell 3-3	Cell 3-2	Cell 3-1
3	o						o					
	Cell 1-12	Cell 1-11	Cell 1-10	Cell 1-9	Cell 1-8	Cell 1-7	Cell 1-6	Cell 1-5	Cell 1-4	Cell 1-3	Cell 1-2	Cell 1-1
	o						o					
1	Cell 1-12	Cell 1-11	Cell 1-10	Cell 1-9	Cell 1-8	Cell 1-7	Cell 1-6	Cell 1-5	Cell 1-4	Cell 1-3	Cell 1-2	Cell 1-1

Figure 7-8 : Location of the cells of the plan X^+ of the composite structure

Couches	12	11	10	9	8	7	6	5	4	3	2	1
8	Cell 8-12	Cell 8-11	Cell 8-10	Cell 8-9	Cell 8-8	Cell 8-7	Cell 8-6	Cell 8-5	Cell 8-4	Cell 8-3	Cell 8-2	Cell 8-1
	o						o					
	Cell 6-12	Cell 6-11	Cell 6-10	Cell 6-9	Cell 6-8	Cell 6-7	Cell 6-6	Cell 6-5	Cell 6-4	Cell 6-3	Cell 6-2	Cell 6-1
6	o						o					
	Cell 4-12	Cell 4-11	Cell 4-10	Cell 4-9	Cell 4-8	Cell 4-7	Cell 4-6	Cell 4-5	Cell 4-4	Cell 4-3	Cell 4-2	Cell 4-1
	o						o					
4	Cell 2-12	Cell 2-11	Cell 2-10	Cell 2-9	Cell 2-8	Cell 2-7	Cell 2-6	Cell 2-5	Cell 2-4	Cell 2-3	Cell 2-2	Cell 2-1
	o						o					
	o						o					
2	Cell 2-12	Cell 2-11	Cell 2-10	Cell 2-9	Cell 2-8	Cell 2-7	Cell 2-6	Cell 2-5	Cell 2-4	Cell 2-3	Cell 2-2	Cell 2-1

Figure 7-9 : Location of the cells of the plan Y^+ of the composite structure


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Couches	1	2	3	4	5	6	7	8	9	10	11	12
7	o					o						
	Cell 7-1	Cell 7-2	Cell 7-3	Cell 7-4	Cell 7-5	Cell 7-6	Cell 7-7	Cell 7-8	Cell 7-9	Cell 7-10	Cell 7-11	Cell 7-12
5	o					o				o		
	Cell 5-1	Cell 5-2	Cell 5-3	Cell 5-4	Cell 5-5	Cell 5-6	Cell 5-7	Cell 5-8	Cell 5-9	Cell 5-10	Cell 5-11	Cell 5-12
3	o					o						
	Cell 3-1	Cell 3-2	Cell 3-3	Cell 3-4	Cell 3-5	Cell 3-6	Cell 3-7	Cell 3-8	Cell 3-9	Cell 3-10	Cell 3-11	Cell 3-12
1	o					o				o		
	Cell 1-1	Cell 1-2	Cell 1-3	Cell 1-4	Cell 1-5	Cell 1-6	Cell 1-7	Cell 1-8	Cell 1-9	Cell 1-10	Cell 1-11	Cell 1-12

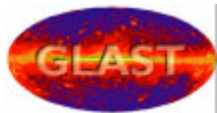
Figure 7-10 : Location of the cells of plan X⁻ composite structure

Couches	1	2	3	4	5	6	7	8	9	10	11	12
8	Cell 8-1	Cell 8-2	Cell 8-3	Cell 8-4	Cell 8-5	Cell 8-6	Cell 8-7	Cell 8-8	Cell 8-9	Cell 8-10	Cell 8-11	Cell 8-12
	o					o				o		
6	Cell 6-1	Cell 6-2	Cell 6-3	Cell 6-4	Cell 6-5	Cell 6-6	Cell 6-7	Cell 6-8	Cell 6-9	Cell 6-10	Cell 6-11	Cell 6-12
	o					o						
4	Cell 4-1	Cell 4-2	Cell 4-3	Cell 4-4	Cell 4-5	Cell 4-6	Cell 4-7	Cell 4-8	Cell 4-9	Cell 4-10	Cell 4-11	Cell 4-12
	o					o				o		
2	Cell 2-1	Cell 2-2	Cell 2-3	Cell 2-4	Cell 2-5	Cell 2-6	Cell 2-7	Cell 2-8	Cell 2-9	Cell 2-10	Cell 2-11	Cell 2-12
	o					o						

Figure 7-11 : Location of the cells of the plan Y⁻ composite structure

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8 PLAN OF THE STRUCTURE



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